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XLII.—*On the Division of the European Seas into Provinces, with reference to the Distribution of Mollusca.* By ROBERT M'ANDREW, F.R.S.

OF the many services rendered to natural-history students by the late Edward Forbes, I have been used to regard as among the most important his observations upon the distribution of marine Mollusca and other Invertebrata, both geographically and vertically, and the consequent division of those seas which formed the field of his researches into zones of depth and into geographical areas marked out by the particular forms or species of Mollusca which had their principal development in each.

I believe that the existence of such natural divisions has been generally admitted by naturalists; but finding, in the abstract of a paper read by my friend Mr. Jeffreys at the last meeting of the British Association, and published in the 'Annals of Natural History' for October last, a statement that, *in his opinion*, such division into provinces is erroneous, I feel called upon to give my testimony in its support, on account of the importance of the question, both in a natural-history point of view and in its bearing on geology. And as I have made rather extensive researches within the area referred to (the seas of Europe and North Africa), with the main object of being enabled to throw light upon the distribution of Mollusca, I hope that I may not be considered over-presumptuous in thinking it probable that no one has had better opportunity of appreciating the correctness of Mr. Forbes's views.

In the first place, it should be clearly understood that the question is one of *fact*, and not to be affected by speculations, however ingenious.

It may be true that naturalists, or, as Mr. Jeffreys terms them, "systematists," are not agreed as to the limits and extent of the

zoological provinces; but this is no argument against the existence of such provinces: there have also been differences of opinion as to the line of demarcation between animal and vegetable life.

With regard to Mr. Jeffreys's remark that he considers "the marine fauna of Europe, Northern Asia, the Cis-Atlantic zone of Africa and part of North America to have been closely related at a comparatively recent epoch, and to form one common area of origin," I would beg to suggest that we have no proof of the large area named ever having been *simultaneously* occupied by a fauna more closely related together than the present; and without entering upon the question of the origin of species, I may remark that most philosophers are agreed that these have originally been developed, or made their appearance, at a single point or centre, and consequently that their tendency must have been always at first to expand the limits of their range. The geographical range of the older species (those which have come down to us from Tertiary times) is generally greater now in the case of all the Southern (or Lusitanian) species, while the Arctic species have suffered a diminution of their territory, at least in latitude, since the "Glacial" age of geology.

The assertion that M. Sars has discovered *Cerithium vulgatum* and *Monodonta limbata* upon the coast of Finmark, if it is to be understood that these species were living, must, unless they were previously transported thither, be founded upon a mistake. That they are actually indigenous in those seas is about as impossible as that the Myrtle, Gum Cistus, or Oleander should be found growing naturally on the adjacent land*.

In reply to Mr. Jeffreys's remark that, because the ocean at a certain depth is of uniform temperature, it is only littoral and shallow-water species that can be affected by climate, I would observe that between shallow water, in its ordinary sense, and those depths of the ocean where the temperature is invariable and equal from the pole to the equator, a great interval exists, and that in fact most, if not all the species of marine Mollusca with which we are acquainted, are to be found living at depths within the reach of climatal influence; also that, notwithstanding that the effects of climate become less in proportion to the depth, yet, so far from finding tropical species in the abysses of

* *Cerithium vulgatum* is a littoral and shallow-water species, though a variety is occasionally to be met with as deep as 40 fathoms; it inhabits the coasts of the Atlantic, from Portugal to the Canary Islands, in addition to the Mediterranean. *Monodonta limbata* is a rare Mediterranean species, which I have never had the good fortune to obtain myself, but have received a specimen of from Sicily. The genus *Monodonta* is unknown in northern seas.

the Arctic Sea, or *vice versâ*, the deep-water species, like others, are limited in their range, and characteristic of the region to which they belong. I have myself dredged at depths reaching to about 200 fathoms on the coast of Finmark, and invariably obtained from the deepest water shells of a peculiarly northern character—for example, *Lima excavata*, *Pecten Grœnlandicus*, *Leda limatula*, and *Chiton alveolus*; and Dr. Alph. Milne-Edwards, in a paper “upon some Animals obtained at great Depths,” quoted from the ‘Comptes Rendus,’ in the ‘Annals of Nat. Hist.’ for September last, mentions, as communicated to him by M. Valenciennes, *Voluta Junonia* from 70 fathoms in the Gulf of Mexico, and *Lima excavata* from 264 fathoms on the coast of Greenland, and that, upon portions of a submarine cable which had been recovered from a depth of 1000 to 1500 fathoms between Cagliari and Bona, he had found *Ostrea cochlear*, *Pecten opercularis* var. *Audouini*, *Pecten Testa*, *Monodonta limbata*, and *Fusus lamellosus*—all species previously known as inhabitants of the Mediterranean Sea.

It is an unquestioned fact that a considerable portion of the species of Mollusca inhabiting any one zoological province may be found in other provinces; but it is not by a simple comparison of the lists of species that we can determine the similarity or divergence of the fauna of separate localities, as the difference between them may consist in a few characteristic forms, which may be especially developed in each. That one and the same marine fauna does not extend from the Mediterranean coast of Morocco to Finmark and Spitzbergen must be patent to the most cursory observer. The former district contains numerous genera peculiar to the warmer region of the earth, where many of them are very widely distributed, including *Conus*, *Cypræa* (as distinguished from *Trivia*), *Typhis*, *Marginella* (as distinguished from *Erato*), *Triton*, *Ranella*, *Pisania*, *Fasciolaria*, *Dolium*, *Cassis*, *Turbo*, *Cymba*, *Cancellaria* (as distinguished from *Admete*), *Mitra*, *Fossarus*, *Columbella*, *Mesalia*, *Gadinia*, *Siphonaria*, *Haliotis*, *Sigaretus*, *Crepidula*, *Argonauta*, *Vermetus*, *Siliquaria*, *Spondylus*, *Chama*, *Cardita*, besides a few supposed to be local, such as *Cassidaria*, *Lobiger*, *Pedicularia*, *Thecidia*, &c., most of which, in the Atlantic, are not to be found beyond the 40th, and none beyond the 50th, parallel of latitude*. The fauna of the Arctic and sub-Arctic regions, though by no means deficient in the number of individuals, is distinguished from that of more southern latitudes by the comparative fewness of its genera and species, likewise by several peculiar genera, as *Trichotropis*, *Admete*,

* One species of *Mitra* and one of *Cardita* inhabit the Arctic seas of America. *Mangelia nana* and *Holbölli* are related to *Astyris (avara)*, Adams, a subgenus of *Columbella*. *Turritella lactea* is not a *Mesalia*.

Puncturella, *Lepeta*, *Pilidium*, and particularly by a remarkable development of certain forms, such as *Bela*, *Trophon*, *Neptunea*, *Margarita*, *Astarte*, *Leda*, and *Crenella*. The intermediate or, as it has been termed, "Celtic" province also offers the most suitable dwelling-place to certain species and genera, most of which extend their range, in diminished numbers, into one or both of the adjacent regions.

Assuming, then, that the fact of the existence of more than one fauna or zoological province within the area referred to (say, north of lat. 32°) is established, it remains to define the limits of each; and this can only be done after careful observation. My own opinion is that the whole area may with propriety be divided into five provinces, sufficiently characterized by the species and genera predominating in each: viz., 1. Arctic; 2. Subarctic or boreal, extending from the Arctic circle to about lat. 55°; 3. Celtic (for which probably a more appropriate name could be found), reaching its southern limit at a point yet to be ascertained in the Bay of Biscay; 4. Cantabrian or Lusitanian, including the north coasts of Spain and west coast of Portugal; 5. The Mediterranean, including the coast of Spain and Portugal as far as Cape St. Vincent and the Atlantic shores of Morocco. For the facts of distribution which have induced me to propose this division, I refer to a report published in the Transactions of the British Association for 1856. It will be seen that these five provinces agree very nearly in their boundaries with those represented by Prof. E. Forbes in his map of "Homoiozoic Belts," published in Keith Johnston's 'Physical Atlas.' The claims of the "Mediterranean province" to be considered distinct are strongly maintained by Milne-Edwards.

It must be explained that the foregoing observations do not apply to the west shores of the Atlantic, which, with the exception of the Arctic and sub-Arctic species, present a fauna totally unlike that of Europe and Africa. The fauna of the Azores, which from its position might be expected to be found intermediate between that of Europe and America, appears, as regards Mollusca, to have no relation with that of the latter continent, but to be in its general character Lusitanian, with the exception of the littoral species, several of which are common to the Madeiran and Canary Islands and to tropical Africa. This fact is particularly deserving of attention, from its apparent relation to an ancient distribution of land different from the present, more particularly as the currents which now prevail across the North Atlantic from west to east, and from the Straits of Gibraltar southward along the African coast, would seem to be opposed to it. As regards the land and freshwater Mollusca of Europe and North Africa, they appear to admit of being divided into

no more than two distinct faunas, the more southern including the countries and provinces bordering both sides of the Mediterranean, the other occupying the temperate regions of Germany, France, Britain, &c., the species diminishing in number as you proceed northward, and only a few extending into the Arctic Zone, from which there appears to be a total absence of any peculiar forms*.

It only remains for me to say that, although the results of my observations may differ materially from those arrived at by Mr. Jeffreys, I am by no means insensible to the obligations we are under to that gentleman for his valuable researches in the British seas, particularly in their remote northern limits, where dredging is a much more arduous occupation than in more genial climes or more sheltered situations.

XLIII.—*On Paramecium? coli*, *Malmsten*.

By R. LEUCKART†.

[Plate XVIII. figs. 12, 13.]

UNDER the above name Malmsten of Stockholm some time since described an Infusorial animalcule ‡ which occurs in the cæcum and colon of man, but had then only been observed twice, simultaneously with ulcers in the colon. In both cases it was present in innumerable quantities, and in the first case was to be found even after the healing of the ulcers, during the continuance of lientery; so that Malmsten is inclined to think that this latter disease might be referred to the parasitism of our Infusory. The description of the parasite, drawn up by Lovén, runs as follows:—

“The animal is cylindrical, oval, a little pointed anteriorly, broader or narrower according to the quantity of nourishment taken in, and narrower also when it moves through the mucus, turning continually upon its axis. Its length is about 0·1 mill. On the external membrane it has a dense coat of cilia, which stand in somewhat oblique series. In front, on one side of the apex, is the mouth furnished with long cilia; and the œsophagus, which is slightly dilated and somewhat curved, penetrates the interior to a considerable depth. In the interior parenchyma a dark streak sometimes indicates the course of a swallowed morsel.

* Greenland is considered by many naturalists to form part of the same province with Northern Europe, and has a few peculiar land and fresh-water shells; but their distinguishing characters are extremely slight.

† Translated from Wiegmann's Archiv, 1861, p. 81, by W. S. Dallas, F.L.S.

‡ Translated in Virchow's Archiv für pathol. Anat. und Physiol. 1857, vol. xii. p. 302, tab. x.